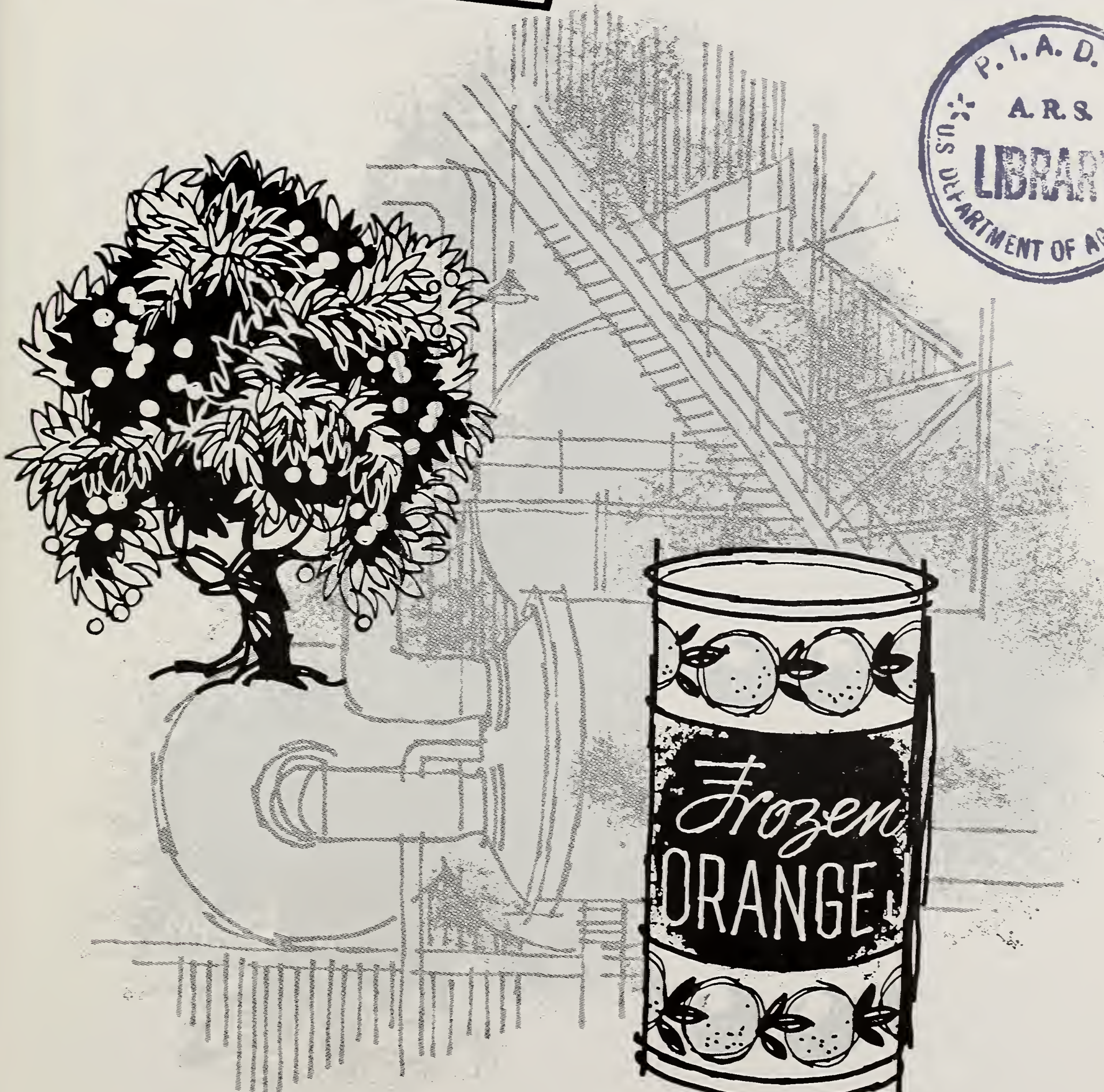
AGRICULTURAL Research

August 1962 / U.S. Department of Agriculture



UTILIZATION RESEARCH ADVANCES RAD *Page 3*

AGRICULTURAL

Research

August 1962/Volume 11, No. 2

Contents

Editor: H. G. Hass. Managing Editor: R. E. Enlow. Contributors to this issue: G. W. Beshore, B. R. Blankenship, V. R. Bourdette, W. E. Carnahan, R. W. Doan, D. W. Goodman, M. E. Haun, G. M. Jones, W. W. Martin, D. H. Mayberry, H. H. Smith, M. T. York

Keeping Pace

New knowledge won through agricultural research is vital to our Nation's future.

Often overlooked, however, is the fact that agricultural research is equally vital right now. It provides the means of holding our own against the many diseases, insects, parasites, and countless other hazards that threaten to drag down agricultural efficiency and cut into the incomes of farmers and the well-being of all of us.

Valuable research on livestock, for example, is giving us better fleeces from sheep, meatier carcasses from hogs, and increased milk and meat production from cattle. But at the same time, livestock producers find an ever increasing number of problems that threaten to nullify these research gains.

Modern trends toward greater movement and concentration of livestock increase the threats of diseases and parasites. Research is being challenged to keep them from getting the upper hand.

Offsetting important gains against brucellosis and screwworms, for example, are our difficulties in coping with shipping fever, anaplasmosis, tuberculosis, and parasites.

- Shipping fever continues to be a costly livestock condition. Despite our best research efforts, really effective methods of controlling shipping fever have not been found.
- We are barely holding our own against anaplasmosis. We're still looking for clearcut ways to control and eradicate this complicated disease on a nationwide scale.
- Tuberculosis has been on the upswing for the last two years and threatens to outrun research efforts.
- Mucosal disease of cattle baffles researchers. Both cause and ways of preventing it are unknown.
- Bovine leukosis is on the increase. Research is struggling to learn as much as possible about this disease.
- We also lack effective control for more than 50 percent of the parasites affecting cattle. Parasites continue to gnaw at growth rate, production, and efficiency of feed use.

Letting up in any area of agricultural research means loss of hard-earned gains as well as failure to move ahead.

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D.C. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is $1 in the U.S. and countries of the Postal Union, $1.50 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Growth Through Agricultural Progress

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

UTILIZATION RESEARCH ADVANCES RAD

RURAL AREAS DEVELOPMENT is a major USDA effort to keep farm communities prosperous and to restore prosperity to those by-passed by technological developments.

Every agency in USDA contributes to Rural Areas Development. An ARS responsibility is to advise community leaders on local processing of farm products and on improving agricultural practices—on the land and in the home. But it goes much further.

Through utilization research, for example, ARS contributes stable markets and new industries to RAD.

A stable market for cotton, citrus, animal fats, and flax is one of the broad effects of utilization research on Rural Areas Development.

Typical of specific recent utilization research contributions to this government wide effort to keep rural America prosperous and growing are dehydrated potato factories in the East, North, and West; frozen poultry processing plants in the Southeast, and alfalfa dehydrating plants in every section of the West.

The Rural Areas Development program is one of USDA's efforts to help people in rural areas increase their incomes by running efficient farms and by establishing industries and businesses in the areas.

The aim of utilization research—to increase present uses for farm products and discover and develop new uses for them—closely supports RAD. There are many specific instances of this support.

Cotton

Until a few years ago, the cotton kingdom was in danger of being usurped by synthetic fabrics. But ARS utilization research developed new markets for cotton by making it flame and water resistant and by contributing to the development of wash-and-wear fabrics. The wash-and-wear fabrics provide an outlet for more than a million bales of cotton a year, creating farm work for hundreds.

Citrus

In 1945, Florida was producing 50 million 90-pound boxes of oranges a year, with immediate prospects of increased output but little prospect of a larger market. ARS, in cooperation with the Florida Citrus Commission, developed a frozen orange juice concentrate, commercialized in 1946. Markets grew rapidly, and during the 1958–59 season 80 million gallons of concentrates were manufactured, using nearly 53 million 90-pound boxes of oranges and stabilizing grower income.

Turn Page

UTILIZATION
(Continued)

Animal Fats

Because it has developed new uses for animal fats, utilization research has offset a declining market for fats and stabilized price. More than 600 million pounds of animal fats are used annually in processed animal feeds. About 50 million pounds a year are used in making plastics. Fats are used to make oleic acid for use in soaps and textile lubricants, and two compounds made from inedible animal fats are now in pilot-plant production of detergents. Use in detergents is expected to amount to more than 100 million pounds a year.

Flax

The flax industry can now better compete with synthetics because utilization research has developed linseed oil emulsion paints with the protective qualities of conventional linseed oil paints and the rapid drying convenience of synthetic paints.

Potatoes

Utilization research has been just as helpful to RAD in developing rural industries and businesses as it has been in keeping the farmer on the farm. As a result of potato products it has developed, 12 potato dehydrating plants are now in operation in potato-growing areas throughout the country. These plants buy about $6.3 million worth of potatoes a year. The impact of these products on the market has reversed the downward trend in per capita consumption of potatoes.

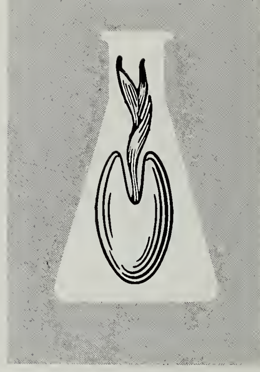
Forage

More than 50 alfalfa dehydrating companies, scattered nationally, are using a method developed by utilization research to stabilize some of the more valuable nutrient constituents of alfalfa and other forages. In 1960, 250,000 tons of dehydrated forages were stabilized by the ARS method, resulting in an additional $1.5 million return.

Poultry

Research which led to an improved quality of frozen poultry has contributed to the 2.5-billion-pound increase in consumption of turkeys and chickens during the past 5 years, and has led to the establishment of additional processing plants in every State in the Union.

There are many other examples of utilization research support to the RAD program. Waste feathers that once cost poultry processors $10 to $20 per ton to dispose of are now made into fertilizers, feeds, and plastics; corncobs are ground and used for cleaning aircraft engines and for producing mulch, poultry litter, and cattlefeeds. And, because of improved production methods, pine gum and maple sirup are more profitable.



Health of the Nation is safeguarded through ARS meat inspection—animal inspection, quarantine—disease eradication

Guarding against threats to our capability to provide U.S. consumers with an abundance of wholesome meat is the goal of three ARS regulatory divisions: Meat Inspection, Animal Inspection and Quarantine, and Animal Disease Eradication.

ARS meat inspectors provide a direct consumer service. When we in this country buy meat that has been properly inspected and labeled, we can be sure it's wholesome. Americans who have traveled in underdeveloped areas of the world can appreciate this security.

In 1906 Congress passed the law requiring Federal inspection for cleanliness and wholesomeness of all meat moving in interstate and foreign commerce. Sixteen years earlier Congress had enacted a law providing Federal inspection of meat for export. The original law helped protect our export markets for meat; the later law helped protect us from adulterated, tainted, or diseased meat.

Federal inspection by veterinarians and other highly skilled inspectors is conducted in more than 1,500 establishments in more than 600 cities. This consumer protection service costs

Eighth in a Centennial Series

HEALTHY ANIMALS, WHOLESOME MEAT

about a penny a month per person . . . a tiny fraction of a cent per pound of meat.

Animal Inspection and Quarantine workers protect our livestock and poultry from diseases of foreign origin; insure the humane exportation of only healthy animals; prevent the production and sale of harmful or worthless biologics; and maintain, through a marketing agreement with manufacturers and handlers, adequate supplies of biologics for protection of swine against hog cholera.

Animal quarantine—originally the responsibility of the Treasury Department—was transferred to USDA in 1884. An effective system of animal inspection, and the quarantine of imported animals until proved healthy, was developed by 1890.

Large force guards borders, ports

Today, approximately 100 ARS veterinarians and inspectors guard our borders and ports of entry. This small force examines all imported live animals, fresh and processed meat, hides, wool, and other animal products, which may harbor diseases.

Animal Disease Eradication workers form the first line of defense against diseases of livestock and poultry which would otherwise make serious inroads on our abundant supplies of foods of animal origin. They identify and eliminate diseases on farms and ranches before such diseases can cause serious economic losses. They prevent the spread of animal diseases from State to State, and insure humane treatment of livestock shipped by rail. They participate in nationwide cooperative State-Federal programs and assist foreign governments in controlling and eradicating serious livestock and poultry diseases.

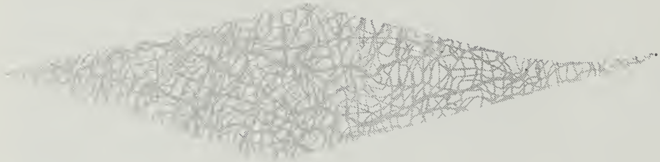
Helping livestock producers protect their animals from diseases was an early task assigned to USDA by the Congress. Contagious bovine pleuropneumonia, the first disease attacked by the new Department, was eradicated by 1892. Many other diseases have been conquered since, among which are the dreaded foot-and-mouth disease, and Asiatic Newcastle disease of poultry.

Eradicating cattle tick fever made possible a widespread cattle industry in the South, and added immeasurably to the economy of the Nation. Dourine, glanders, vesicular exanthema, and fowl plague, once well known in our country, have become names in textbooks following eradication. The highly successful programs to eradicate tuberculosis and brucellosis have resulted in the conservation of enough extra meat and milk to supply 7,500,000 Americans. Among others, the campaign against hog cholera is gathering momentum, and screwworms are being effectively controlled in the South.

Disease eradication is less costly

When sufficient scientific knowledge is available to eradicate livestock diseases, it is less costly to eliminate them than to continue to live with them. Not only must the economic benefits to the Nation and the livestock industry be considered, but the health of the public, as well. Many diseases of humans are contracted from diseased livestock or animal products, and the animal disease eradication programs have prevented much human illness and suffering.

Not only do farmers benefit from these activities, but all of us who need the nutrients of meats, milk, and other foods of animal origin. A healthy livestock population is essential to the public health.☆



GLASS FIBER MATS PROTECT WATERWAYS

Glass fiber mats, installed in strips across newly seeded waterway, withstood four times the flow of other materials.

Glass fiber mat was the most effective of seven materials evaluated in Oklahoma tests for ability to protect newly seeded grass waterways.

The materials were rated by ARS hydraulic engineer W. O. Ree according to the velocity of water they withstood without damage to the waterway or the material. The studies were at the Stillwater Hydraulic Laboratory, with the Oklahoma Agricultural Experiment Station cooperating.

Temporary protection of new waterways is needed until the grass is established. Runoff can damage the waterway, making regrading and reseeding necessary. Grassed waterways carry flood runoff from terraced and contour-cropped fields, as well as from roadways and airports.

Ree found that a glass fiber channel lining withstood more than four times as much water discharge as the next best material tested. This mat, about 1 inch thick, is made of fine glass fibers and is similar in appearance to insulation.

The tests were conducted in a channel with a 6-percent slope. This channel had a shallow V cross-section, 10 feet wide and 6 inches deep. The test section was 100 feet long.

Each material was subjected to flows of increasing velocity. Tests lasted 40 minutes, unless channel damage occurred sooner.

The glass fiber mat withstood a discharge rate of nearly 4 cubic feet per second. For this test, 10-foot lengths of the mat were placed crosswise in the channel and fastened with a continuous row of T-head pins. In tests where the material was installed lengthwise in the experimental channel, and with less pinning, the maximum flow without damage was 0.7 cubic foot per second.

Under similar test conditions, fine mesh jute cloth installed lengthwise withstood a discharge of 0.8 cubic foot per second. This cloth is made of 1/4-inch twisted yarn, with openings 3/8 by 5/8 inches.

Close-weave paper mesh, asphalt emulsion with hay mulch, paper net with hay mulch, and coarse mesh jute cloth withstood 0.3 cubic foot per second flow. Asphalt emulsion and paper fiber failed in the first test.

Ree also tested glass fiber mat for ease of penetration by vegetation. He found that Bermudagrass comes through glass fiber mat readily. Bermudagrass is commonly planted on waterway channels on the Southern Great Plains. Further testing with other grasses is needed.

For each material tested, Mr. Ree determined its hydraulic roughness (or Manning's n value). This is an index of the friction generated when water flows across the material.

Knowing this index, an engineer can calculate the water velocity a material would withstand in any channel of known slope and dimensions. He can then select the most practical and economical lining. ☆

UNDERSTANDING SOIL COMPACTION

Pigweed root system failed to grow through compacted soil layer.

In chisel row, cotton roots penetrated.

Between chisel points, cotton roots fanned out.

Several theories have been advanced to explain why plant root growth is restricted or halted by layers of compacted soil just below tillage depth. Scientists have suggested that (1) moisture supply in the compacted layer is insufficient, (2) air supply to roots is inadequate, or (3) roots simply cannot penetrate the soil.

Results of USDA experiments support the latter theory. In these experiments, root growth slowed or stopped only when the soil had so much resistance to penetration (strength) that roots could not force a passage. Air and water supplies were adequate in the compacted layer.

These studies, by ARS soil scientists H. M. Taylor, Earl Burnett, and N. H. Welch, were undertaken to gain a better understanding of how undesirable soil structure affects root growth. This information will be useful in designing tillage systems for soils where compacted layers are a problem.

The compacted soil layers are caused by passage of machinery across cultivated lands or by repeated tillage at the same depth. The compaction, which occurs on the Southern Great Plains and elsewhere in the U.S., is variously called plowpan, hardpan, tillage pan, pressure pan, or claypan.

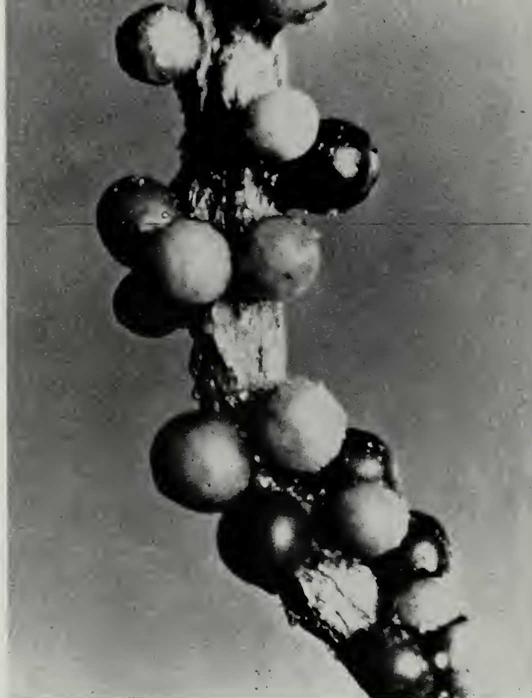
Taylor, Burnett, and Welch did their research on Amarillo fine sandy loam soil at Big Spring, Tex. The plots were artificially compacted in the spring with a farm tractor or road roller. Some plots were chiseled or sweep-tilled, leaving a compacted layer below tillage depth; other plots were not tilled after compaction. The plots were planted to cotton, guar, sesbania, Mung beans, cowpeas, or sorghum.

The scientists determined soil strength with a force gage or penetrometer, which measures the force required to push a $^{3}/_{16}$-inch-diameter tip three-sixteenths of an inch into the soil at the point of measurement. Measurements were made when the soil was holding the highest amount of moisture it could contain under conditions of free drainage.

In compacted, untilled plots where soil strength measurements were 400 pounds per square inch or higher, root growth was severely restricted. Growth was satisfactory in uncompacted soil with strength measurements of 250 pounds per square inch or lower. In compacted, tilled plots, with strength measurements between 250 and 400 pounds per square inch, roots failed to penetrate the compacted layer if the soil was dry but developed normally in wet soil.

Root growth patterns were similar in the five crops tested. ☆

SOIL FUMIGANT STOPS GOLDEN NEMATODE



The war against golden nematodes may soon be over. ARS plant pest control scientists believe the soil fumigant dichloropropane-dichloropropene (D-D) is the right weapon.

USDA and the New York State Department of Agriculture and Markets started an all-out campaign against the pest in 1960. That was after 5 years of field tests convinced researchers 90 gallons of D-D per acre could destroy the enemy.

But before development of this effective chemical weapon, there were years of simply holding the line against the golden nematode. Almost from the time of its first appearance in this country—on Long Island in 1941—ARS and New York State developed and used regulatory and control measures. These kept the imported pest confined in small portions of Long Island potato-growing areas.

During that time, Cornell University, with the help of ARS, was doing research on ways of eliminating golden nematodes. Scientists were looking ahead to the day farmers could again grow potatoes on Long Island land that had been infested.

Golden nematodes attack potatoes and tomatoes mainly. They are so small they can't be seen by the naked eye, except in the cyst stage. There are no signs of them until plants become stunted. If no potatoes or tomatoes are near, the pest can lie dormant in the soil 20 years.

Eggs of the pest overwinter in the dead female nematode body, which becomes a golden colored protective cyst. In spring, when the soil temperature is about 60° F., potato roots give off a chemical that stimulates the larvae to hatch from the eggs. The larvae enter the roots and suck the life out of the plants. In some experimental areas of Long Island, golden nematodes have destroyed up to 85 percent of the potato crop.

The State's removal of infested land from production has given the most important control. Quarantine regulations have helped prevent spread of the pest. The regulations prohibit sale of seed potatoes from the quarantine area, and require all potatoes shipped to the consumers' market to be packaged in non-reusable paper bags. Quarantine regulations also prohibit the movement of used farm machinery, nursery stock, topsoil, and root crops from an infested area.

Cornell scientists have screened thousands of potential nematode-killing chemicals, experimented with crop rotation, and worked on developing nematode-resistant potato varieties. By crossing and back-crossing, they developed a variety that has shown much resistance to nematode attack in field tests during several years.

When ARS scientists first tried D-D in 1946, they applied 45 gallons

Greatly magnified golden nematode cysts are seen (left) on potato root. Pest can lie dormant in soil for 20 years.

Scientists locate (above) infestations by examining the washed residue of soil under microscope.

Member of field survey crew picks up soil samples from a field in Long Island potato area.

Before applying fumigant, soil is plowed to 8-inch depth; then smoothed uniformly.

One tractor can fumigate 10 acres a day. Fumigant output is kept constant with tractor speed.

per acre in a single application. This reduced the number of nematodes but didn't eradicate them.

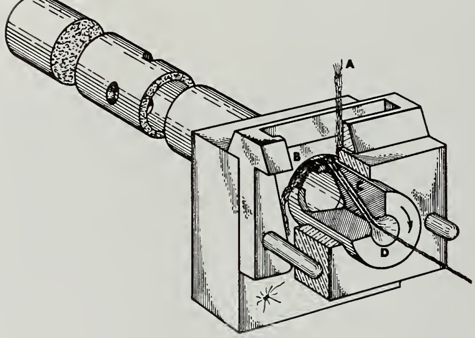
ARS, New York State, and Cornell resumed field tests of D-D in 1955. Scientists applied 90 gallons per acre in two equal treatments, 10 days apart, and turned the soil between treatments.

This method was effective during 1956–1959. So, in 1960, using improved equipment for better distribution of D–D, the control workers treated 744 acres. ARS scientists found no living nematodes in treated soil, and the State approved the land for potato production.

In 1961, 1,275 acres were treated with D–D. This was so successful that the plan was to treat 1,500 acres this year. Continuing applications, ARS scientists believe, eventually will eliminate the pest. ☆

A STEP TOWARD

AUTOMATED COTTON SPINNING MILLS



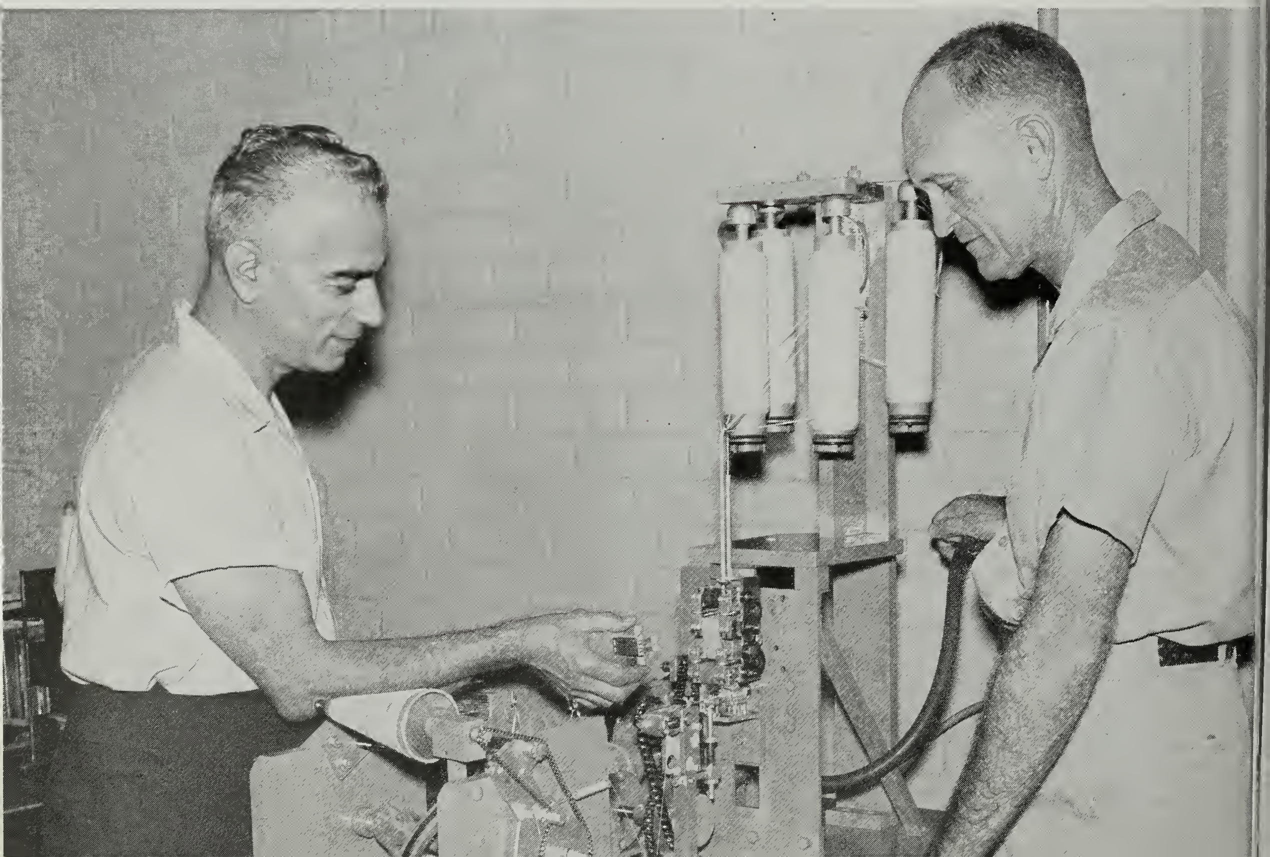
Fibers enter (A); then contact twisting yarn tail on surface of revolving spindle (B). As yarn is spun it is drawn into hole (C) and out (D) to winding device.

A radically new experimental cotton spinning machine, developed by USDA engineers, may be an important step toward eventual automation in cotton spinning mills.

Although additional research will be needed to perfect its operation. the prototype apparatus has demonstrated advantages that could lead to considerable savings of time and labor required in spinning cotton yarn.

Inventors of the new machine, called the SRRL Ringless Spinning Machine, are ARS engineers G. J. Kyame and H. R. Copeland of the Southern utilization research laboratory, New Orleans. Their machine spins cotton without the use of bobbin, ring, or traveler, which limit the rate of yarn production and the size and shape of yarn packages in present-day spinning.

G. J. Kyame and H. R. Copeland operate Ringless Spinning Machine.



The engineers say the experimental model has two major faults. First, the machine puts more twist in the yarn than is desirable. Second, the yarn varies in thickness and strength along its entire length, and its appearance is inferior to commercial yarns.

In conventional spinning, a bobbin is mounted on a spindle that revolves inside a closed ring at speeds up to about 12,000 revolutions per minute. As the bobbin turns, twist is imparted to a strand of fibers, converting it into yarn. The yarn, in turn, is wound around the bobbin.

Commercial yarn production rates are limited by (1) an upper limit on the speed of the tiny metal guide, the traveler, that moves around the closed metal ring to wind the yarn on the spinning bobbin; and (2) the small size of the ring, which limits the size of the bobbin and makes frequent bobbin changes necessary. Less than half a pound of yarn of the size used in print cloth, for example, can be wound onto a bobbin. This means yarn from the bobbins has to be rewound into larger packages for further processing.

In the new SRRL Ringless Spinning Machine, the bobbin, the ring, and the traveler have all been eliminated. The yarn is wound directly from the spindle into packages of any shape or size needed for later processing steps. This eliminates the time and labor now required to change bobbins and rewind yarn.

The manufacture of cotton yarn consists of an expensive series of disconnected processes. Although several of these processes have been combined or connected, many textile people agree that the full advantage of automation cannot be realized in spinning mills until present processes are replaced by an entirely new spinning procedure. The Ringless Spinner is a step in this direction. ☆

Clean cotton had unshielded cultivation and spray; weedy rows had only cultivation.

NEW INSIGHT TO WEED CONTROL

Unshielded cultivation boosts herbicide kill

More effective ways of using herbicides and cultivators to control weeds in cotton appear likely through research by USDA and the Mississippi Agricultural Experiment Station.

One of the most significant findings of the research is that *unshielded* cultivation can be used in fields treated with preemergence herbicides. In the past, only *shielded* cultivation was used in such fields to avoid disturbing treated soil—a band about 12 inches wide that includes the crop row.

In unshielded cultivation, shovels move soil to cover weeds in the crop row. In shielded cultivation, shovels do not disturb the band of herbicide-treated soil. Shields attached to the cultivator prevent soil from being thrown on the treated area in the crop row.

ARS agronomist J. T. Holstun, Jr., found that unshielded cultivation late in the season actually supplements preemergence application of diuron, a herbicide of low volatility widely used in cotton. Soil thrown into the row covers and kills very young weeds not killed by diuron and also kills some weed seedlings that develop after diuron loses its effectiveness.

In Holstun's studies, a combination of preemergence and postemergence herbicide applications proved most effective. Both herbicide treatments, supplemented with unshielded and shielded cultivation, gave most satisfactory weed control.

Early in the season, shielded cultivation eliminates weeds between the rows, while herbicides control weeds in the rows. Later in the season, as herbicides lose effectiveness, unshielded cultivation kills weeds in the rows. It also greatly reduces the need for postemergence herbicides, flaming, and hand-hoeing.

One combination of treatments, developed in Holstun's 3-year series of field experiments, begins with a diuron application. One or two applications of a postemergence herbicide are made during shielded cultivation. After this, unshielded cultivation is combined with hoeing to give full-season weed control.

If future research confirms past findings, farmers can look forward to simpler and more effective weed control in cotton fields. ☆

Peaceful use of atomic energy provides engineers with improved way to measure

SILAGE DENSITY

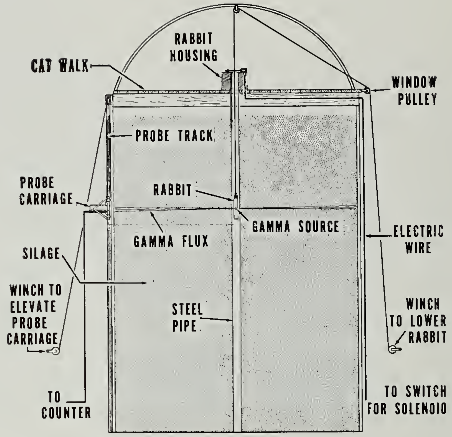


DIAGRAM OF SILO SHOWING LOCATION OF EQUIPMENT

Atomic energy is helping USDA agricultural engineers measure silage density in an upright silo without handling the silage. It has never before been possible to make such measurements without removing samples from the silo.

Through this basic experimental work, the engineers hope to learn more about what happens to silage after it is ensiled. It will also give engineers data useful in designing stronger silos and may lead to improved methods of filling upright silos. This research is being done by ARS engineers P. E. James, D. E. Wilkins, and J. R. Menear at the Agricultural Research Center, Beltsville, Md.

The engineers determine density by measuring the amount of radiation coming through the silage from a radioactive source—Cesium-137—within the silo. The source is lowered in a pipe installed in the center of the silo before the silo is filled.

A radiation detector outside the silo picks up radiation coming through the silage. As silage density increases, the amount of radiation coming through decreases. The detector sends radiation—in the form of electrical impulses—to a receiver where it is recorded on graph paper. From the graph, variations in silage density at different heights in the silo can be calculated.

As silage settles, its density increases; this causes pressures of varying amounts to build up throughout the silo. These pressures sometimes become so great they cause a silo to rupture or break open.

Present methods of measuring silage density are not accurate, and measurements can be made only once. Random samples (plugs) of silage are taken through openings in the silo. When samples are taken, air gets into the silo and the decomposing silage causes further density changes.

TOP—P. E. James adjusts radiation detector outside silo. BOTTOM—D. E. Wilkins checks relayed impulses.

The engineers are working with grass silage because it causes most silo ruptures. They plan periodic density measurements while the silage is in storage and while it is being fed. The silage is not radioactive.☆

BASIC RESEARCH:

GRAIN INSECT CONTROL

New research laboratories in Georgia and South Dakota will gather basic research on the physiology, ecology, biology of about 40 grain insects

Scientists at two new USDA research laboratories constructed at State agricultural experiment stations are seeking basic scientific knowledge they hope will lead to better control of grain insects.

Dedication and formal opening of the basic research laboratories took place this summer at Brookings, S.D., and Tifton, Ga.

A more thorough knowledge of the physiology, ecology, and biology of about 40 major grain insects is the primary aim of work at the laboratories, according to ARS entomologist R. G. Dahms. Such information will be used in developing more effective methods of chemical, biological, and cultural control.

Dahms emphasizes the need for basic research by citing estimated annual losses caused by grain insects at about $1 billion.

Research at the Southern Grain Insects Research Laboratory at Brookings is cooperative between USDA and State agricultural experiment stations in South Dakota, Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Minnesota, Nebraska, North Dakota, Ohio, and Wisconsin.

Research at the Southern Grain Insects Research Laboratory at Tifton is cooperative between USDA and the State agricultural experiment stations in Georgia, Alabama, Arkansas, Florida, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

Grain-growing areas not included in Southern or North Central States will benefit from basic knowledge gained by research at the two installations.

Director of the Brookings laboratory is W. L. Howe, formerly in charge of USDA's Forage Insect Laboratory, Lincoln, Neb. H. C. Cox, director of the Tifton Laboratory, was formerly in charge of corn insect investigations at Tifton. Each will have a staff of 10 senior scientists and their assistants. ☆

Brookings scientist studies relationship of insect, host plant, disease.

Tifton entomologist readies canister of insects for radioactive exposure.

FOR 50 YEARS INSPECTORS HAVE

GUARDED OUR BORDERS AS THE FRONT LINE

DEFENSE AGAINST PLANT PESTS

Early this century auto traffic across the Mexican border presented little pest risk.

Last year more than 24 million vehicles entered the U.S. from Mexico, greatly increasing the danger of plant pests.

Half a dozen innocent-looking oranges in a traveler's suitcase . . . . cotton stuffing in a souvenir of that trip to Europe . . . the soil clinging to a man's boot.

These are just a few of the out-of-the-way places where ARS plant quarantine inspectors found damaging foreign pests at U.S. ports of entry during the past year as they ended half a century of guarding this country against foreign pest invasion.

It was 50 years ago this month, on August 20, 1912, that the U.S. established its first foreign plant quarantines, directing USDA to maintain a front line of defense against foreign plant pests.

The significance of this action is demonstrated by the fact that foreign plant pests that got into the U.S. *before* the Plant Quarantine Act was passed in 1912 continue to cost American farmers and consumers more than $5 billion a year.

Entomologists hesitate to guess how great these losses would be if the flow of foreign plant pests had continued unrestricted into the U.S. during the past half century.

Before the white man came to America it was relatively free from serious plant pests. This situation changed rapidly. Stem rust fungus came to Massachusetts before 1700. Many other plant pests arrived during the 18th and 19th centuries: Hessian fly, gypsy moth, boll weevil, European corn borer, San Jose scale, European red mite, greenbug, and alfalfa weevil. Entomologists estimate that 92 different insect species were introduced during the half-century immediately preceding 1912.

Equally destructive foreign plant pests continue to knock on our doors: Mediterranean fruit fly, khapra beetle, and the durra stalk borer—a pest considered to be as damaging as the European corn borer.

Commercial agricultural imports, a source of many new insect infestations before 1912, now move through a system of inspection and treatments that guard against introducing foreign plant pests.

The baggage of the individual traveler, who is generally unaware of the danger posed by a few oranges, a handful of soil, or the plant he picked up abroad, now poses the greatest danger of foreign pest introduction. In cooperation with Customs officers, plant quarantine inspectors last year examined a piece of incoming baggage every $1\frac{1}{2}$ seconds.

Thus, USDA, with the cooperation of other Government agencies, commercial carriers, and travelers themselves, continues to hold the line against the thousands of foreign plant pests that are now roving the world, attacking crops abroad, and threatening to pick the pockets of American farmers and consumers.☆

AGRISEARCH NOTES

Beta-carotene process improved

Citrus byproducts have been successfully substituted for the expensive chemical beta-ionone in experimentally producing beta-carotene, an important source of vitamin A. Beta-carotene is used to supply vitamin A to pharmaceuticals and animal feeds and as a food coloring.

Either citrus pulp ($35 a ton) or citrus molasses ($20 a ton) can replace beta-ionone ($9 a pound) in the process, which involves fermentation by a carotene-producing mold.

This development, by Alex Ciegler, G. E. N. Nelson, and H. H. Hall of the ARS Northern utilization research laboratory, Peoria, Ill., represents further refinement of the beta-carotene fermentation process announced by USDA a year ago.

The lower cost, possible with citrus byproducts, should make the fermentation process competitive with present-day chemical methods of synthesizing beta-carotene. The fermentation process provides a fiber-free, high-vitamin-A product needed in mixed feeds, especially for poultry.

The ARS scientists found that 3 to 5 percent of citrus pulp or 0.1 to 1 percent of citrus molasses in the fermentation nutrient medium stimulated carotene synthesis as much or more than the use of 0.1 percent of beta-ionone. They also observed that carotene synthesis began sooner in flasks containing citrus pulp than in those containing beta-ionone.

In the new process, the nutrient medium for growing carotene-producing mold contains citrus byproduct, cottonseed meal, cornmeal, vegetable oil, deodorized kerosene, and vitamin B–1. Mating strains of the mold *Blakeslea trispora* are grown together on this medium.

The yield of beta-carotene obtained in the process is higher, on a dry-basis content, than carotene content of ordinary plant materials.

New brome grass boosts mixture

Improved production from forage crop mixtures containing brome grass should be possible in several North Central States when seed of a new smooth brome grass variety becomes available in 1965 or 1966.

The new variety is named Sac, developed in cooperative research by USDA and the Wisconsin Agricultural Experiment Station.

In 10 years of trials in Wisconsin, Sac has been consistently superior to better known commercial varieties in resistance to foliage diseases. Seedling establishment, in the trials, has been highly satisfactory as a result of Sac's improved tolerance of soil-borne organisms that reduce stands of most other varieties.

Sac has good vigor under Wisconsin conditions. Plants spread quickly and have moderately coarse leaves and stems. The seed is heavy like the seed of other northern brome varieties. Forage yield is about the same as yield of the better known commercial varieties. Sac is well adapted in the northern corn belt.

Breeding work was done by E. L. Nielsen, ARS geneticist, and P. N. Drolsom and D. C. Smith of the Wisconsin Agricultural Experiment Station.

Quick check on water table

Observation wells only three-eighths of an inch in diameter accurately record changes in water table depth more quickly than standard 4-inch wells, USDA scientists report.

This finding opens the way for scientists to gain more precise knowledge of changes in ground-water supplies used for irrigation and domestic water. The more sensitive but less expensive small wells can also supply information needed by engineers in designing drainage systems and restricting seepage losses from reservoirs and canals.

A team of researchers headed by ARS agricultural engineer L. C. Benz compared large- and small-diameter test wells, 12 feet deep, in fine-textured soil near Grand Forks, N. Dak. Accuracy of readings was determined by tensiometers, which show changes in soil moisture that may accompany fluctuations in the water table. Differences in water table depth readings were small but significant.

Total installation costs per well were $2.95 for the small size and $7.96 for the large size.

Potato resists greening in light

USDA plant breeders are developing a variety of potato that resists greening when exposed to light.

Greening of tubers is a major problem in markets, since shoppers do not readily buy such potatoes.

Green color can occur to some extent in tubers of all commercial varieties. Usually, greening becomes serious only after potatoes are exposed to natural or artificial light in retail stores. Most potatoes color only

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON 25, D.C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID PAYMENT OF POSTAGE, $300 (GPO)

slightly or not at all during harvesting, storage, and shipping, because the tubers are protected from exposure to light except for very short periods.

ARS potato breeder R. V. Akeley already has selected three breeding lines that are without the greening characteristic. No change in skin coloring was found in these lines after 200 hours of exposure to a combination of subdued daylight and fluorescent light.

In addition to greening resistance, the new lines have high yielding ability and are resistant to all common races of late blight. Two lines resist mild mosaic, and one the golden nematode.

More work is required to incorporate desirable characteristics in the breeding lines. Then, field tests will be necessary before a variety can be made available to growers.

Salty subsoil kills seedlings

Scientists can now explain why seedings of desirable forage species on the salt-desert shrub lands of the West germinate and apparently become established—then die.

Most of these shrub lands—nearly 40 million acres—are in Utah and Nevada. Shrubs tolerant to salty soils are the primary vegetation.

It is known that these soils contain salts at concentrations most plants cannot tolerate. But the *location* of these salts was unknown until results of greenhouse tests in Utah revealed that topsoil is comparatively free of salts.

In tests of six species, plants emerged and grew well in soil from the top 6 inches of typical salt-desert shrub land. But in soil taken from

depths of 6 to 36 inches, seedlings did not emerge, and vigorous transplants of crested wheatgrass died.

These results, plus substantiating results of chemical analyses of the soil, explain why plants germinate and start growth, then die when roots reach the unfavorable subsoil.

ARS range conservationist A. C. Hull, Jr., conducted the tests in cooperation with the Utah Agricultural Experiment Station.

Now that scientists know this characteristic of salt-desert shrub soils, they stand a better chance of eventually finding or developing salt-tolerant forage species.

High grain ration exceeds return

Cows receiving a high-concentrate ration may produce more milk but return less money than cows receiving a low-concentrate diet.

That was the case with a group of cows studied at the Western Washington Agricultural Experiment Station, Puyallup. Their rations were changed monthly. When given large amounts of grain, they produced more milk but at less profit than when fed a limited-grain diet.

When the cows each got about 20 pounds of grain daily, production averaged 3.75 pounds higher than when fed 10 pounds a day. At going prices, the extra milk was worth 16 cents but cost 31 cents to produce.

Average production of the group was 15,410 pounds in 305 days. Each cow produced more economically (returns over feed costs) on the limited-grain diet. The study, sup-

ported by ARS funds, was made by Washington dairy husbandmen F. R. Murdock and A. S. Hodgson.

Cows lost about 0.75 pound daily on the limited-grain diet. Such losses probably aren't harmful, say the scientists. Weight can be regained late in lactation and in dry periods on diets composed mostly of inexpensive forage. Cows on the high-grain diet gained 1 pound a day. On either grain diet, each also got 10 pounds of hay daily and all the grass silage she wanted.

This study shows that each dairyman should analyze the feed and price situation to figure his best grain-feeding level, say the scientists.

U.S. GOVERNMENT PRINTING OFFICE: 1962